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March 14, 1975

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NASA Headquarters
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Dear Noel:

I am here setting down, at your request, a summary of the Viking-related concerns which I set out to you and Gerry Soffen in our discussions last week. There are two general concerns, first about the high-latitude B landing site, and second about the general question of the quality of specialized scientific advice which Viking is able to secure. The two problems are connected.

The high latitude (44°N) Viking landing sites were selected for several reasons: One seems to be as a compromise between those who say that life is most likely to be found at the equator and those who say it is most likely to be found at the pole. Since the edge of the polar cap generally never comes as near the equator as 44°N, we have in this case fallen between two stools. The 44°N terrain is not geologically remarkable and the equatorial terrain is extremely heterogeneous. Many other geologically exciting low-latitude sites exist.

The remaining argument for 44°N depends upon Barney Farmer's contention that there are certain locales and seasons where the vapor pressure of atmospheric water will be sufficiently large that small quantities of interstitial liquid water will be found in the Martian soil. As I argue below, Farmer's argument has not been subjected to adequate critical scrutiny. In fact it has not even been published, although it was written several years ago. The same argument was, I believe, first put forward by Joshua Lederberg, Elliot Levinthal and myself in a paper published in 1968. I do not know if the argument is wrong; I merely am very doubtful that this argument should have great weight in the selection of a landing site.

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The main objection to 44°N is of course that it is inaccessible to ground-based radar and that radar in many other locales on Mars has found places of such low or high dielectric constant as to make landings unsafe or impractical. The argument is put forward that we will not go to the B site until the A mission has successfully landed. But the plan is to go to the B site before even a single biology experiment has been attempted by the A lander. In my view we cannot be confident that all experimental systems on Viking will work as planned, and therefore cannot be cavalier in our choice of the second landing site. It must be, I believe, just as safe as the first landing site. I keep thinking of the possibility that there is life all over the planet but that the biology experiments fail in the A mission and the descent operations fail in the B mission. This and many similar scenarios that can be imagined would be a disaster of the first magnitude. The at best small increment in the probability of our finding life at 44°N is far outweighed by the decreased safety at that latitude. I would urge that the existing C sites by substituted for the existing B sites.

There are two elements in these decisions which have unfortunately not been subjected to the most exacting standards of competent scientific scrutiny. These are the Farmer model and the interpretation of radar signatures and their correlation with optical signatures. Viking experimenters were selected of course with particular experiments in mind. Luckily, in biology, there are extremely broad-gauged biologists, such as Joshua Lederberg and Alexander Rich, who have been selected for their general excellence and not for association with any given experiment. This is not to the same extent true in the physical sciences. Physicists of the very highest caliber -- Freeman Dyson or Edwin Salpeter for example -- have not made inputs into the very difficult physical questions on which the success of the mission depends. I would therefore urge the organization of working scientific meetings on the critical radar and water questions in which participants are selected not because of their connection with the Viking mission but because of their recognized competence in the relevant physics and chemistry. These would not be show-and-tell meetings, in which people summarize progress made at their home institutions, but rather working scientific discussions in which each critical step is displayed and criticized. The success of such meetings depends greatly on the abilities of the Chairman who must himself have demonstrated competence and impartiality on the subject. But such people exist and can be persuaded to participate in such meetings. I would be happy to supply a list of candidate participants for those two meetings. If Viking failed after such meetings, at least we would have the knowledge that the best available scientific advice had been secured.

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Beyond these immediate problems I think it would probably be prudent to arrange for Viking a very small, perhaps no more than 5 person, physical science advisory group of the highest caliber to render advice on whatever other problems of this nature may emerge. My experience is that the very best physicists are happy to consider problems with the scientific excitement and potential of Viking, if only the problems are put to them capably and the significance of their potential contributions underscored.

None of the foregoingremarks are intended as criticism of the existing Viking protocol; it is simply that physical science problems much more complicated than had been anticipated are being encountered, and that we obviously need the most competent advice available.

With all good wishes,

Cordially,

Carl Sagan

CS:jf
cc: G. Soffen
J. Lederberg
T. Owen